Getting Past the Obvious

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Abstract

Long Leaf Creek is located within an urbanized watershed along coastal North Carolina. The specific stream reach addressed is located in a residential subdivision. Conditions had dramatically changed there due to the continued development of the watershed. The stream had deepened and widened as result of increased runoff and high concentration events, including hurricanes. This increased the loss of aesthetic value, riparian corridor vegetation, and aquatic and terrestrial habitats. Water quality was also degraded.

Before they could decide how best to control flooding and stabilize and restore Long Leaf Creek to a naturally functioning channel within its changed watershed conditions, citizens had to be educated about natural stabilization and restoration technologies and specificmethods that would work, including conventional options. Soil bioengineering was agreed upon, with numerous modifications to meet specific needs.

This paper is presented from both the client's and consultant's perspectives. It identifies what worked, what did not work, and what was necessary to improve the process for successful, long-term results. We present the lessons learned from criteria issue development and understanding, educational process alternatives preparation, design, construction, and project results since construction.

Paper

Long Leaf Creek is located within an urbanized watershed along coastal North Carolina. The specific stream reach addressed is approximately 2000 feet in length and is located in a residential subdivision. It is a highly sensitive project with a variety of multi-objective goals specific to its location and function and typical to urbanizing areas. The watershed includes residential, office, institutional, and commercial properties, including 25 homes that line the creek in this area. Residents living along the creek described the former Long Leaf, as a small, picturesque stream that pleasantly flowed through their neighborhood--a stream that could be jumped across. It was enjoyed by many people. The conditions had dramatically changed, however, due to the continued development of the watershed, especially a new road and large shopping center immediately upstream. Residents have seen their stream deepen by almost ten feet and widen by 40 feet in areas, a result of increased runoff and high concentration events, including hurricanes. In many areas, the banks were vertical. Large, woody debris filled much of the channel, and many people were now using the "ditch" as a yard and construction waste dump (see Figure 1). This has resulted in increased the loss of aesthetic value, riparian corridor vegetation, and aquatic and terrestrial habitats. Water quality has also been degraded.

Many people had already lost property due to stream widening and were unwilling to lose more. Flooding was a major problem in the downstream end, while erosion was occurring throughout the project reach. The City of Wilmington was interested in exploring a natural approach to solving the problem. After assessing the site and conditions, and listening to the residents= concerns and desired solutions, it was clear that a strong, continual working relationship had to be formed with the neighborhood to ensure project success.

Figure 1. Pre-Construction Conditions

Before they could decide how best to control flooding and stabilize and restore Long Leaf Creek to a naturally functioning channel within its changed watershed conditions, citizens had to be educated about natural stabilization and restoration technologies and the specific methods that would work, including comparative conventional options. To “get past the obvious,” it was clear that almost everyone would have to give up some land and existing trees to solve their continued land loss and flooding problems and to improve the environmental and aesthetic values of Long Leaf Creek. How much land and how many trees they would lose would ultimately depend on their selected restoration alternative. A matrix was developed using critical issues and matching these to possible alternatives (Table 1). Soil bioengineering was agreed upon, with numerous modifications to meet specific needs.

Robbin B. Sotir & Associates, Inc., (RBSA), served as the soil bioengineering consultant to the prime, the Kimley-Horn’s interdisciplinary team, developed the geotechnical design and hydraulic eff iciencies of a soil bioengineering solution to address the desired goals and critical engineering, environmental, and aesthetic issues.

Alternatives were compared with such critical issues as erosion control, streambank stabilization, safer and healthier environment, flood control, timely project completion, environmental and aesthetic improvement, property loss minimization, hydraulic efficiency, and cost feasibility.

After an initial investigation, an alternative analysis was produced in the summer of 1997. This alternative analysis explored numerous approaches to solving each of the project goals, with cost and risk factors assigned to each alternative. Several alternatives were considered, such as box culverts, 3:1 (horizontal : vertical) grassed slopes, 2:1 riprap rock, 2:1 concrete lining, and soil bioengineered slope systems. With input from the residents and permit authorities, the City selected the soil bioengineering approach and commissioned a design team to produce plan and specification documents, including construction cost estimates.

The selected systems employed the use of live fascines, brushlayer/live fascines, joint planting and vegetated geogrids (see Figures 2 through 5).

The majority of the improvement was done using vegetated geogrid, due to its soil reinforcing capabilities and ability to reduce land losses (see Figure 6).

Pre-bid, preconstruction, and permit application services were provided to support the project. Construction was completed by the spring of 1999.

The project has performed well from a biological perspective. Willow, baccharis, and myrtle installed as cuttings in the lower layer had a survival rate of approximately 80%. The rooted stock installed in the upper two layers comprised of spirea bush, Carolina allspice, serviceberry, and viburnum, were less successful, with a survival rate of approximately 60% due to an insect infestation (see Figure 7). Hydraulically, we have had some bed scour, accompanied by toe erosion.

The survival rate of the rooted stock would have been higher had the watering maintenance program been followed. It is also possible that the insect infestation would not have occurred if the plants had been kept healthier by better maintenance practices. The rooted plants will be replaced by the contractor under the maintenance agreement. The contractor is also responsible for taking care of the insect infestation. The bed scour in the upper level caused by Hurricane Floyd is being handled with check dams to stop the bank from lowering and to control the toe scour.

Table 1. Long Leaf **Hills/Hewletts** Creek Alternatives and Critical Issues

Critical Issues	Alternatives Intermediate Action	 3:1 Side Slopes Grass Lining’	 2:1 Side Slopes Riprap Rock’	 2:1 Side Slopes with Concrete Lining*	 Reinforced Box Concrete	 Soil Bioengineering
Stop Erosion & Stabilize Banks		●	●	●	n/a	●
Clean Out Trash & Debris, Remove Fallen Trees	●	●	●	●	●	●
Safer & Healthier Area		●				●
Control Flooding		●		●	●	●
Timely Project Completion	●	●		●	●	●
Environmental Improvement		●			●	●
Aesthetically Enhancing		●			n/a	●
Meets Hydraulic		●		●	n/a	●
COE and Environmental Permits Approval Probability	●					●
Minimize Property Loss	●				●	●
Preliminary Cost Estimate Range	$250,000 to $400,000	$640,000 to $800,000	$900,000 to $1,400,000	$785,000 to $1,200,000	$1,750,000 to $2,300,000	$1,000,000 to $1,300,000

‘Does not address geotechnical issues of sandy bank material stability and major land loss requirements.
*Does not address increased safety concerns or reduction in property values.

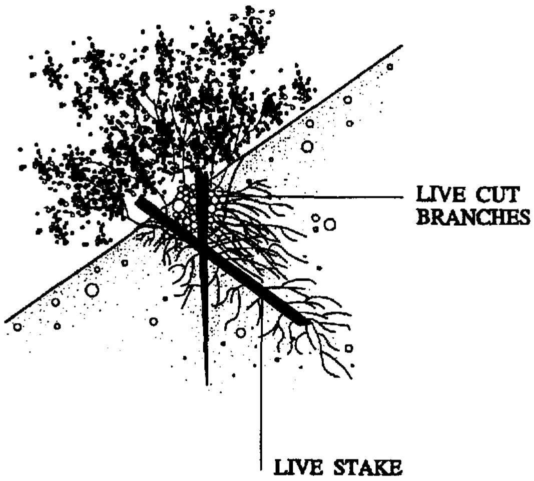

Figure 2. Live Fascine.

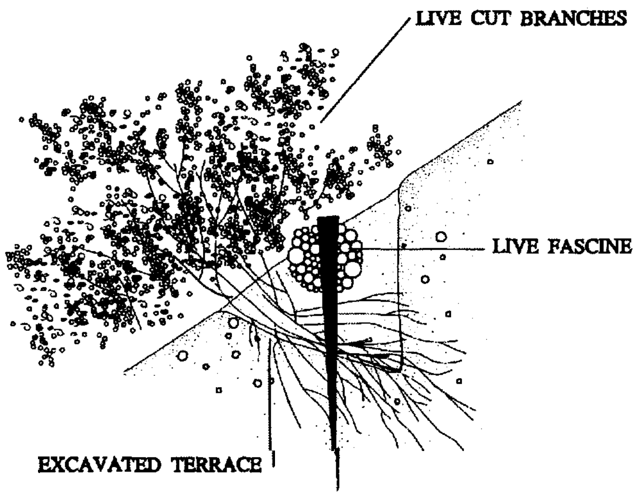

Figure 3. Brushlayer/Live Fascine.

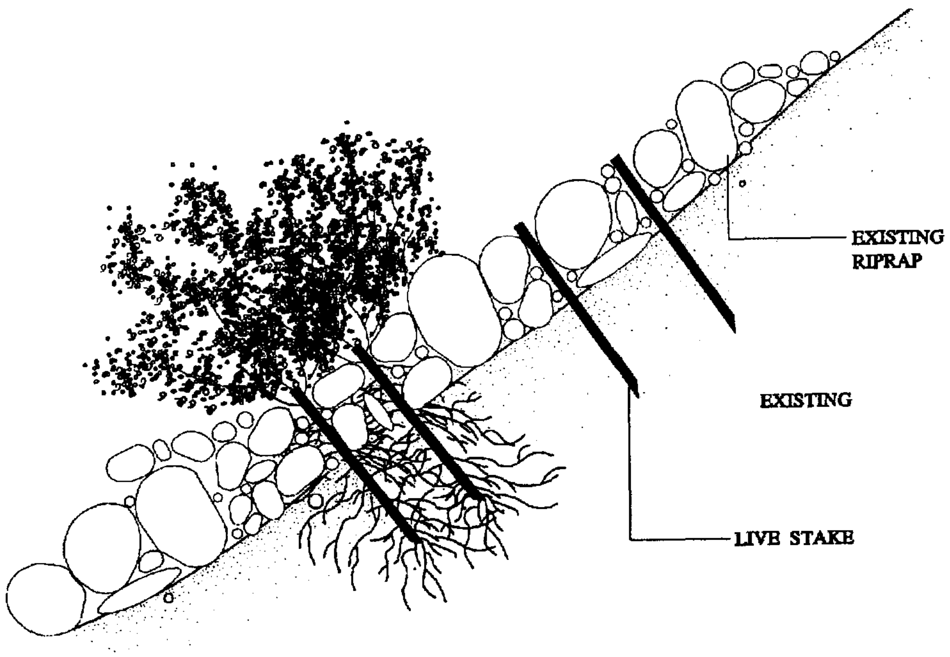

Figure 4. Joint Planting.

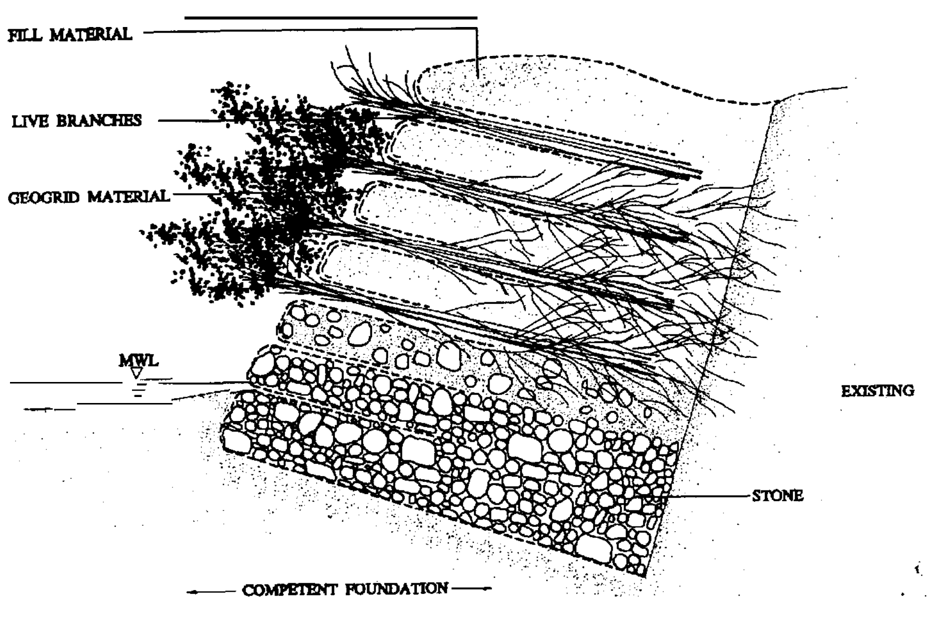

Figure 5. Vegetated Geogri

Figure 6. During Construction.

Figure 7. Three Months After Construction.

The project is functioning well from the bank stability and flood control aspects and the stream is operating within the parameters of the new watershed conditions. It is aesthetically attractive and, over time, should develop some ecological diversity. In summary, it is clear that the soil bioengineering approach is succeeding. The most important lessons learned were as follows:

- Learn more about the bed conditions in areas that have had high deposits of mobile materials
- Employ sophisticated grade control structures
- Ensure installation procedures are followed correctly and that materials are not changed
- Keep tabs on the contractor's maintenance schedule
- There is no substitute for communication and cooperation

Reference

Sotir, R.B.; "Brushing Up On Erosion," American Cities and Counties, February, 1998.